Binaural Beat Technology and its use in Transpersonal Practice and Methodology

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Introduction

Sound plays an important role in the lives of sentient beings. It is one of the fundamental methods by which the world is experienced and a primary doorway to perception. If asked, many can likely recall moments of driving in the car and listening to music that invoked an extremely intense and seemingly unintended rush of emotions. Engrossed in such moments, perhaps even with tears rolling down cheeks, drivers may have found themselves bellowing the tune to their favorite song with a revelry and exuberance that may have even forgotten where they are or what they are doing. Imagine the embarrassment when while stopped at a light these aspirants noticed the expressions on the faces of the people in a car next to them! Music and sound move people not only emotionally, but physically and mentally as well. People often can't help but move when they hear pleasing music and bodies seem unconsciously attuned to the input that is heard.

On some occasions, music may result in a powerful shift in perception. This shift, at times, may be so intense that those experiencing it may find themselves thanking God, Tao, the universe or some other metaphor representing a higher power simply because they see things anew for a moment. Often this experience may be accompanied by a gratefulness and contentment far beyond description in words. In the minutes and hours following such random "Peak" moments, (Maslow, 1968), perhaps those coming out or reflecting upon this shift in consciousness marveled at the way that an antecedent as simple and readily accessible as an inspiring song on the radio had propelled them with such ease and unpredictability into such a far reaching state of consciousness and accompanying bliss.

> As you are listening to me, listen not only to me, but to everything about you. Listen to all those bells, the bells of the cows and the temples; listen to the distant train and the carts on the road; and if you then come nearer still and listen to me also, you will find there is a great depth of listening. But to do this you must have a very quiet mind. If you really want to listen, your mind is naturally quiet, is it not? You are not then distracted by something happening next to you; your mind is quiet because you are deeply listening to everything. If you can listen in this way with ease, with a certain felicity, you will find an astonishing transformation taking place. In your heart, in your mind-a transformation which you have not thought of, or in any way produced (Krishnamurti, 1964).

For others, sound provides somewhat less spiritually significant but also useful experiences. Some may sit for hours in a room listening to the same songs over and over again, relishing the comforting feeling that the music offers. Some may wonder why they find the music so encompassing and personally inspiring, others may just know that the experience of those sounds made them feel good, at ease and relaxed. Some spend hours lost in a meditative trance or repetitive auditory experience as they listen over and over again to music or sounds that they enjoy others may find that they are more artistically inclined while engrosses and surrounded by sound. When people are upset music often can help them feel better. When anxious, it can calm nerves. When afraid, it seems to offer confidence. People may use music or sound in this and many other ways before the big game, on the way to the first day of school or after a disastrous first date. Examples abound of sounds made by nature, such as tree's swaying, the ocean, water running, the wind blowing, crickets singing or frogs chirping helping calm and ease difficult feelings. Depending on experiences from the past, sounds may conjure feelings associated with home, family or safety.

Conversely, harsh or jarring sounds such as chalk on a blackboard, screams or loud machinery may have the opposite affect on the psyche. People may find themselves

feeling agitated, nervous and unable to focus. The sound of an infant crying, for example, gives many such an inherent and instinctually programmed sense of urgency that they may struggle to focus on anything else until the sound abates. This seems to be an inherent and genetically programmed autonomic response to the stimuli. These are neurologically programmed physical responses to sound.

Many seem to agree with this feeling of deep connection to sound. New fathers and mothers place recorded sounds of whales, water, the ocean and the womb near infants to help them calm at night. Sales of meditation CDs, nature sounds and water fountains continue to soar and can be found in many stores worldwide. In fact, it seems that sound is one of the most widely accepted forms of developing community and connection that exists worldwide. From concerts and radio to symphony, movies and dance, music and sound appears to be relied upon not only personally but collectively by humanity as a means to access and induce mental, emotional, physical and spiritual states of experience.

With regard to transpersonal practice, sound has been used in a myriad of ways to assist and induce spiritual experience in virtually every religion or spiritual school of thought throughout history. From loud, soulful Baptist church choirs to the ominous and solemn chanting of Ohm in Transcendental Meditation. From the repetitive drumming embedded in indigenous culture to the whirling trance dance music used in Sufi practices. In many ways accessing the divine by auditory means has been a true and useful ally throughout history.

Today, with the ever evolving technological advancement integral to our culture, we have increasingly more specific and powerful instruments by which to integrate sound

into transpersonal practice. The auditory tools available and distributed today at affordable prices to average citizens offer incredible potential and opportunity for harnessing the power of auditory experience as a means of mass personal and collective spiritual growth worldwide. What's more, the production and distribution of such tools has never been more simple or expeditious, no matter where you live or what your financial means may be.

. One field of research that offers some interesting potential with regard to the impact of sound is the field of neuroscience. Neuroscience is the study of the human neurological system. Traditionally this field was a more biologically focused field of inquiry. However recent findings and experimentation offer increasingly useful information about the physiological link of the brain with mind and how they interact with each other.

> There's a revolution going on. There used to be two systems of knowledge: hard science-chemistry, physics, and biophysics-on the one hand and, on the other hand a system of knowledge that included ethology, psychology, and psychiatry. And now it's as if a lightning bolt had connected to two. It's all one system, neuroscience...The present era in neuroscience is comparable to the time when Louis Pastuer first found out that germs cause disease (Hutchinson, 1986).

As Hutchinson states, neuroscientific evidence compiled and discovered in the past thirty years, especially, offers useful insights into auditory methods which may not only compliment, but potentially multiply the effectiveness of our existing and accepted transpersonal meditative tools and methodology. On the other hand, to the field of neuroscience and its emergent experimentation, transpersonal research methods and theoretical perspectives offer scientific and theoretical tools by which to begin to more

effectively measure and compare aspects of consciousness and the mind which are currently beyond reach of its existing research methodology and approach.

> There is no objective way to measure mind or consciousness with an instrument. Mind consciousness appears to be a field phenomenon which interfaces with the body and the neurological structures of the brain. One cannot measure this field directly with current instrumentation. On the other hand, the electrical potentials of brain waves can be measured and easily quantified. Contemporary science likes things that can be measured and quantified. The problem here lies in oversimplification of the observations. EEG patterns measured on the cortex are a result of electroneurological activity of the brain. But the brain's electroneurological activity is not mind-consciousness. EEG measurements then are only an indirect means of assessing the mind-consciousness interface with the neurological structures of the brain (Hunt, 1995).

As Hunt suggests, the methodology available in most mainstream scientific inquiry for studying and mapping the transpersonal realm of existence is beyond the scope of the limited tools available. In this regard, the time may be very ripe for neuroscientific and transpersonal theory and research to partner in approach and epistemology. Binaural beats and their impact on mental states is an example of a topic that requires this potential partnership for accurate investigation.

In order to move forward with such a partnership, it seems useful to begin at the existing limits of each discipline and attempt to take a step beyond those limits together. The neuroscientific study of electroencephalograph or EEG activity in the brain when measured and documented offers a useful and predictable base upon which to begin more accurate inquiry into the impact of binaural beats on consciousness or mind states. Because it is fairly limited in scientific and theoretical methodology when it comes to abstract or qualitative entities such as the transpersonal realm, neuroscientific research on consciousness may greatly benefit from specifically designed qualitative, heuristic and transpersonal approaches to the study of binaural beats. As it is somewhat hindered in its

quantitative, clinical and medical understandings of the chemical and neurological characteristics of such phenomenon, transpersonal research too has much to learn in such a partnership. Binaural beats may offer an excellent opportunity in this regard, given that the auditory beats, which will be better explained later in this paper, seem to induce a neurologically measurable set of responses in the brain to auditory stimulus which may result in the ability to entrain the mind to reach altered states of consciousness. This is fairly broad and complex statement to make. In order to explain the justification for such a statement, it seems that an introduction to binaural beats and an explanation what is thought to be known about them is in order.

Therefore, this paper seeks to introduce the basic terms associated with this phenomenon, explore some initial implications of using binaural beats in transpersonal practice and offer an eye toward potential for future research and exploration. Reflection and exploration on both scientific and religious approaches and understandings pervade this paper. In fact, it is the hope that an integration of those and other dichotomous perspectives may be displayed throughout the following pages and future work on this topic.

Science without religion is lame, religion without science is blind.

-Albert Einstein

Definitions

The general terms used in the study of binaural beats are offered as introduction to the topic.

Hertz (Hz)

Hertz is a unit of measurement which is equivalent to cycles of a process or moving entity per second. For the purposes of this paper, Hz is used in the measurement of brain and auditory wave frequency cycles. For example, if a brainwave is measured at 400 Hz, it is cycling through its entire length at a rate of 400 times per second. The higher the number, the faster the stimulus is moving or cycling through itself and the more stimulated the pattern of sound or thought is occurring (Atwater, 2004).

Brainwaves

Brainwaves are rapid fluctuations of voltage or electrical charges that occur between parts of the cerebral cortex or upper portion of both halves of the brain. Researchers have been utilizing EEG machines to measure brainwave activity in participants for some time. By observing brainwave activity, researchers can determine what general part of the brain is active in the moment and any of the loosely defined states of awareness that a given participant may be experiencing at any given time (Oster, 1973). By then documenting and analyzing the rhythm and characteristics of that particular brainwave activity and comparing what they have seen among other participants, researchers can provide useful information and discoveries regarding our internalization of external stimulus, patterns of thought and overall psychological interactions with the world. It is important to have a working knowledge of the four different general categories of brainwave rates or frequencies according to current scientific research and a general idea what mental, emotional and spiritual experiences could be associated with each. In doing so, the hope is to better understand the impact

that binaural beats may have on consciousness. The four types of brainwaves generally agreed upon in the field of neuroscience are; Beta, Alpha, Theta and Delta.

Beta waves

Beta waves are typically associated with a normal daily state of consciousness. The frequency of brainwaves during this state is said to be between 13 and 100 Hz (Oster, 1973). Beta is the fastest and most common pattern of brainwave activity. "A combination of all four brain waves is occurring at all times. However, when in beta state, the beta waves are of greater amplitude or strength, and are therefore more predominant" (Harris, 2007). This statement, that all the waves are present to some degree in the brain, but dominant frequencies emerge in accordance with different experiences is a generally relied upon assumption in neuroscientific experimentation. Additionally, it is assumed that there is a link between overall stress and brainwave activity. In other words, the faster the brainwaves are moving in terms of frequency, the higher the intensity of experience is occurring. Speeds of over 30 are generally considered "higher-end" beta waves, so anything more than that is a state of increase stress overall.

These increased times of speed or activity in the beta state are associated with moments of increased agitation, distress or uneasiness. If the brain is experiencing increased agitation, the body responds autonomically to that agitation and speeds up as well. As the heart speeds up, we may breathe faster, perspire or experience a variety of other physiological responses. During their most frequent patterns, beta wave brain patterns appear to reflect the cellular experience of primal threat or fear known as the "fight or flight response." This response causes the body and mind to experience reality

as if under attack. Such an experience of traumatically sensed reality, when experienced for a prolonged periods of time, may produce clinical symptoms associated with mental illnesses, addictive behaviors and significant changes in physical well being.

> Dysfunctional and addictive behaviors, neurosis and strong feelings of separation are common experience when the brain operates in the extreme high end of the beta range. The extremes of the beta range are also associated with what scientists call the "fight or flight response" (Harris, 2007).
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> The overarching principle of the fight-or flight response is marshaling resources for immediate needs in lieu of building for the future-act now, ask questions later. The hormonal rush of epinephrine focuses the body, increasing heart rate and blood pressure and dilating the bronchial tubes of the lungs to carry more oxygen to the muscles. Epinephrine binds to muscle spindles, and this ratchets up the muscles' resting tension so they're ready to explode into action. Blood vessels in the skin constrict to limit bleeding in the event of a wound. Endorphins are released in the body to blunt pain. In this scenario, biological imperatives like eating and reproduction are put on the back burner. The digestive system shuts down; the muscles used to contract the bladder relax so as not to waste glucose; and saliva stops flowing (Ratey, 2008).

The link between high range beta brainwaves and the cultural environment in which people reside offers a reminder of the powerful impact that culture plays on an individual person. For example, the collective culture of this country is an outwardly focused, externalized world where people's senses are bombarded with increasingly intense stimulus. Many seem to rush to keep in step with the collective expectations of accomplishment and efficiency that govern this society. The faster people go, whether driving or at work, the more efficient they are and therefore the more successful they are considered to be. Many tend to sleep too little and push themselves to exhaustion in the search for success and self worth. Many do not make time to quiet the mind and just be still, because this does not match these overall conceptions of accomplishment. In terms

of the mind, this emphasis on fast, intense experiences without quietude indicates that a disproportionate amount of time is spent in a high end beta range of brainwave state.

In other words, many people today spend most of their time in some level of emergency mode. The previous quotes from Ratey and Harris illustrate some of the transformations that occur when in this state. Neuroscientific research seems to suggest that these changes originate when the brain introduces and assimilates a perceived stimulus and reacts, whether conscious or unconsciously to that stimulus. Over time, the brain forms actual neurological pathways and the brain changes biologically. The brain and thought patterns actually physically changes over time in an attempt to adapt to surroundings. People who suffer from ADHD and anxiety based symptoms may be reacting to the experiences of their environment. Said another way, they may have effectively changed their mental state in an attempt to adapt. This would explain the significant difference noted in terms of illness among various cultures worldwide.

If your mind isn't clouded by unnecessary things, this is the best season of your life.

-Wu-Men.

Alpha waves

Alpha brainwave patterns are much slower than beta, averaging between 8-12.9 Hz (Oster, 1973). Bill Harris describes the higher end mental state associated with these brainwaves as that which is experienced "soon after closing your eyes and relaxing" (Harris 2007). If beta waves can be compared to the daylight experienced on this planet, alpha waves could be compared to the moments of dawn and twilight leading to early or late night that are experienced during transition from day to night or night to day. The

initial stages of sleep and ending times when returning to waking consciousness are filled with alpha wave patterns. In terms of transpersonal practice or mindfulness, alpha seems as if it could be associated with increased mysticism and an altered state of consciousness. This change in mind which might also be considered an expansion of awareness may paradoxically include an inward focus of attention as the mind calms and becomes quiet. Calming of the brain allows the body to release further calming nuero-chemicals which result in a state of physical and mental placidity (Ratey, 2008). In contrast to the specific and focused state of consciousness associated with beta waves, this state seems to relax the grip on specificity and allow the mind to begin to wander and expand its viewpoint. What was concrete now begins to become abstract, what was expected is not so set in stone.

Taking a moment to calm the mind and body appears to open and expand the view in order to see things more clearly. This idea, that higher end frequencies or faster brain wave activity decreases the scope of our personal vision, makes sense in terms of evolutionary history as well. During times of crisis, there is a need to be able to focus in closely on the danger being presented (Ratey 2008). When calm and clear, relaxation can occur and with it an increased view of reality. No wonder spiritual traditions emphasize the importance of "Quieting the mind," That is exactly what they mean. Slowing brain waves may very well be, in essence, quieting the mind and calming the body.

According to Bill Harris, the higher end of the alpha range has been identified by researches as the state that offers a "super learning" state of awareness (Harris, 2007). It is within this mental state that experiences referred to as "Ah ha" moments may occur in which we experience sudden understandings that had been previously hidden from view.

The increased potential for absorption of material may be linked to the relaxing of the mind and releasing of the grip associated with beta brainwave activity. In other words, while in an upper alpha state of consciousness, the brain may more easily be able to connect and merge with stimulus, absorbing it more completely and easily into consciousness. The practice of visualization, hypnosis and other trance inducing transpersonal methods seem to specialize in assisting people in this regard. Maslow's "peak experience" may also occur during moments of predominantly alpha brainwave patterns.

> Peak experiences are sudden feelings of intense happiness and well-being, and possibly the awareness of "ultimate truth" and the unity of all things. Accompanying these experiences is a heightened sense of control over the body and emotions, and a wider sense of awareness, as though one was standing upon a mountaintop. The experience fills the individual with wonder and awe. He feels at one with the world and is pleased with it; he or she has seen the ultimate truth or the essence of all things (Maslow, 1968).

According to Carl Jung, consciousness is like an "Iceberg," with most of the range of consciousness residing outside of normal everyday beta awareness (Jung, 1945). If this is true, it makes sense that stimuli are absorbed and integrated more easily in this state, as more of the brain is able to be used. Increased whole brain thinking may make learning more transformative and useful. Emotionally, when the brain is in a predominantly alpha brainwave state, one may feel an increased sense of awe and contentment as well, which could provide increased emotional or affective attachment to the learning experience. The brain may be opening a doorway to a much more vast type of experience and capacity for learning. It's no wonder that such an experience would feel somehow more powerful and important. Many spiritual practices rely on this merging between the alpha and beta states of awareness in providing the doorway between what is considered sacred information or

guidance and that which is commonplace and agreed upon. Shamanic drumming circles, Sufi dancing and Christian prayer are just a few examples of methods by which transpersonal or spiritual practitioners have assisted participants in establishing a visit to the alpha brainwave state .

Harris says that most traditional forms of meditation seek to train participants on methods of discovering and remaining within the lower alpha states (Harris, 2007). During this shift into a deeper alpha state, the body responds by what Dr. Herbert Benson describes as a "relaxation response."

> Dr. Herbert Benson of the Harvard Medical School termed the concept of relaxation response. In this state, instead of being mobilized to deal with external danger, we are turned inward for introspection, learning, relaxation and renewal This relaxation response appears to be the opposite of the more well known fight for flight response. The heart rate and blood pressure reduce, muscles relax, and an increasing percentage of oxygen flows to the brain (Benson, 1975).

In transpersonal terms, the movement from person to transpersonal may be the time when what Joseph Chilton Pearce referred to as the "Crack in the Cosmic Egg" may begin to occur (Pearce, 2002). The crack in the cosmic egg metaphor implies that the world that was previously experienced as limited or contained begins to show signs of breaking down and, like an animal emerging from its egg, life fights to emerge anew. The experience of sinking into slower and slower brainwave patterns may be a process of increasingly plugging into the cosmic consciousness that has been described as theorists and spiritual gurus as the Tao or God. It is possible that such a state could even be that described as nirvana or heaven. It could be that the spiritual maps from history attempt to guide toward an experience of returning to what neuroscience now describes in terms of increasingly slower brainwave patterns. Transpersonal phenomena such as extra sensory

perception (ESP), shared dreaming and teleportation begin to take on new meaning in terms of actual human experience with this model.

Obviously, people spend far less time in daily lives focused on an alpha state than in the beta range. Far less of experiences in consciousness are turned inward at the inner world and perceptions than outward at the physical external world that surrounds. Far less time is spent in the transpersonal that personal mind state. This imbalance is a good reminder of the importance of meditation and other methods of slowing the mind. It is a good example of the importance of cultivating an ongoing daily practice which includes trips to the transpersonal levels of awareness as often as able and of the value in seeking out effective and easy methods to assist in this endeavor.

Theta waves

Theta waves typically range between 4 and 7.9 Hz (Oster, 1973). The upper range of this frequency is the brainwave pattern that occurs during most dreaming, when the body experiences "rapid eye movement" or REM state. Dream state and the experience of dreaming while aware is a practice used throughout history to access guidance and knowledge from the transpersonal realm. Lucid dreaming may be an experience that occurs during theta brainwave state. As the mind moves to theta brainwave states, glimpses of memories or experiences may occur, but for the most part research suggests that participants are in semi conscious moving to an unconscious state (Harris, 2007). As this continues to deepen, experiences may move beyond description or ability to comprehend. In terms of meditation practice, Harris considers a theta state to be an extremely advanced level of experience and one which most meditators are unable to reach for any significant amount of time.

> Generally, even very advanced meditators attain a theta state for only moments at a time. Studies of Zen monks have shown momentary bursts of heightened theta during meditation. Many psychologists believe the theta state is the doorway to the unconscious mind (Harris 2007).

If indeed the deepening of theta state is a sinking into the realm, mysterious and little known, but presumably vast expanse of awareness known as transpersonal consciousness, it seems very possible that the slower the brainwaves, the more the brain organ is capable of whole brain integration and a resultant feeling of connection with all else. In such a state, it is likely that divisions, dichotomies and maps completely melt away and what was once considered either internal or external just simply is. There is no right, left, good, bad, dark or light. There is no need for language or metaphorical communication, as those methods in themselves are birthed from the conscious mind and limited to this world.

Given the vast and limitless potential of such a perspective, it is no wonder that the prophets throughout the ages spoke in such a contradictory and paradoxical fashion. It is no wonder that Taoist and later Buddhist teachers sought to propel the mind out of its normal state of thought using apparently conflicting prose. In one sense, these teachers may have been struggling to describe something that is simply beyond description. In another, they may have been trying to lead their pupils beyond the ego. Perhaps this is what seekers throughout history were trying to share after catching glimpses of the deep theta range of brain activity and beyond. Perhaps they were experiencing increased oneness or connection with the beloved or divine.

> To study Buddhism is to study the self. To study the self is to forget the self. To forget the self is to be one with all things. To be one with all things is to be enlightened by all things, and this traceless enlightenment continues forever
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> -Dogen Zenji

Delta waves

If the transition from deep theta state to delta is the mysterious doorway to the unconsciousness, the deepening into full delta is that which lies beyond. The frequency range for delta state is between 0.1 and 3.9 Hz (Oster, 1973). It is the brainwave pattern typically associated with deep, dreamless sleep and very little is known about what truly occurs subjectively during this time or if in fact the term subjective can even accurately apply. Jung's description of this state is the "Collective unconscious," in which a return to an experience of unity and oneness with all else occurs (Jung, 1945). In Christian traditions, this state may be considered that experience when most at one with God. In Taoist philosophy, this would be in a state fully aligned with the way of Tao. It is a timeless, eternal state of being. To date, there have been no documented meditators who experience the delta state without also indicating all of the other signs of physical, emotional and mental deep, dreamless sleep. Physically, this is a time where the organism slows, rests, and replenishes itself. In terms of consciousness, this is a time when people would fully experience unity consciousness, or complete connection with all else. It appears to be a time when no categories apply and divisions are no more.

> Unity consciousness is not so much a particular wave as it is the water itself. And there is no boundary, no difference, no separation between water and any of the waves. That is, the water is equally present in all waves, in the sense that no wave is wetter than another.
>
> -Ken Wilber

Oliveri Nucleus

The Superior Oliveri Nucleus is located within the Medulla Oblongata portion of the brain, or the brain stem area. There is one for each ear and they meet in the middle. Oliveri Nucleus is the auditory hub or the sound processing center of the brain and the primary sensory processing area for all auditory experiences. Nerve impulses from the

left and right ears meet in each accompanying nuclei and blend in the upper portions of the brain to produce a coherent auditory landscape. It is thought that the response to binaural beats originate in this portion of the brain (Oster 1973).

Binaural Beats

Binaural beats result from the interaction of two auditory impulses or tones of different frequency that occur simultaneously at below 1000 Hz of frequency. The reason that the sound waves must be below 1000 Hz, according to Oster, is that below 1000 Hz the waves are longer than the diameter of the human skulls. Oster explains why this is important;

> Thus, signals below 1000 Hz curve around the skulls by diffraction. The same effect can be observed with radio wave propagation. Lower-frequency (longer wave length) radio waves (such as AM radio) travel around the earth over and in between mountains and structures. Higher-frequency (shorter wave length) radio waves (such as FM radio, TV, and microwaves) travel in a straight line and can't curve around the earth. Mountains and structures block these high-frequency signals. Because frequencies below 1000 Hz curve around the skull, incoming signals below 1000 Hz are heard by both ears. But due to the distance between the ears, the brain "hears" the inputs from the ears as out of phase with each other. As the sound wave passes around the skull, each ear gets a different portion of the wave. In summary, it's the ability of the brain to detect a waveform phase difference that enables it to perceive binaural beats (Oster, 1973).

In addition to being below 1000 Hz, sound waves introduced to the brain seem to need to vary in frequency between 1 and 30 Hz.

> For example, if a pure tone of 400Hz is presented to the right ear and a pure tone of 410 Hz is presented simultaneously to the left ear, amplitude modulated standing wave of 10Hz, the difference between the two tones is experienced as the two wave form mesh in and out of phase with the superior Oliveri nuclei. A conventional binaural beat generates two amplitude modulated standing waves, one in each hemisphere's Oliveri nucleus. Such binaural beats will entrain both hemispheres to the same frequency, establishing equivalent electromagnetic environments and maximizing inter-hemispheric neural communication (Atwater, 1988)

In other words, the slight beat of difference between one ear and another is justified or integrated auditorily and autonomically initially within the brain stem when internalized. The listener doesn't hear as much as perceive the slight difference, but the theory is that when this stimulus is introduced to the brain, the brain inherently or sub-consciously picks up on this 1 to 30 Hz beat or lapse in sound and begins to form neural pathways in accordance with that phenomena that seems to produce changes in perception.

> Within the sound processing centers of the brain, pulse simulation provides relevant information to the higher centers of the brain. In the case of a wave form phase difference the electron pulse rate in one part of a sound-processing center is greater than another. The differences in electron pulse stimulation within the sound processing centers of the brain are an anomaly. The anomaly (the difference in electron pulse stimulation) comes and goes as the two different frequency wave forms mesh in and out of phase. As a result of the constantly increasing and decreasing differences in electron pulse stimulation, an amplitude modulated standing wave (the binaural beat) is generated within the sound processing centers of the brain itself. It is this standing wave which acts to entrain brain waves (Atwater, 1988).

Scientific interest and inquiry in the potential impact of binaural beats on consciousness was sparked by an article published in Scientific American by Dr. Gerald Oster of Mt. Sinai Medical Center in 1973, entitled, "Auditory Beats in the Brain." Shortly after the introduction of this phenomenon, Robert Monroe of the Monroe Institute of Applied Sciences began investigating this phenomenon by documenting the changes that occurred in brain wave activity using an EEG while thousands of research participants listened to general noise or static with binaural beats interspersed in the sounds. The idea to use pink noise or static sounds over the beat came about through the studies that occurred during this time frame at the Monroe Institute when researchers

noticed that participants more easily shifted brain wave pattern when these sounds were integrated with the beats (Atwater, 1988).

Various researchers have tested, verified and confirmed the impacts that binaural beats have on the brain. In an early study conducted by Dr. Arthur Hastings in 1975, entitled "Tests of the Sleep Induction Technique," binaural beats were engineered to induce binaural beats in the brain for assistance in sleeping.

> We were able to test the effects of the sleep tape on brain waves with an EEG machine through the courtesy of the researchers at the Langely-Porter Neuropsychiatric Institute, part of the University Of California Medical School in San Francisco. Dr. Joe Kamiya, director of the Psychophysiology of Consciousness Laboratory, monitored the brain-wave frequencies of one subject as he listened to the sleep tape. The chart showed a typical sleep onset patter: initial alpha waves, then slowing of the brain waves with sleep spindles, and finally a patter of stage 2 and 3 sleep brain waves in the low theta range...the patterns in the various stages suggested that the tape was influencing the subjects state (Hastings, 1975).

A double blind study was conducted at Duke University in 1996. 180 volunteers were unknowingly presented with binaural beats of 1.5 Hz (delta), 4 Hz (theta), 16 Hz (alpha) and 24 Hz (beta) randomly mixed in with tapes not including binaural beats.

> This study provided evidence that the presentation of simple binaural auditory beat stimuli during a 30 minute vigilance task can affect both the task performance and the changes in mood associated with the task (Thompson, 1997).

The introduction of the beat is but one part of the process. It is the tendency of the mind to attune to that introduced frequency that allows the opportunity to play a part in the brain's natural process and corresponding mental states. The beat appears to be able to act as a sort of tuning fork to the brain which naturally attunes to the frequency or speed that is introduced. What seems very exciting from the initial research completed is that repetitive practice of this beat, if it proves legitimate, has the potential to actually change

the neural chemistry of the brain, presumably shifting the way that participants truly perceive or experience the world.

Frequency Following Response/Brainwave Entrainment

The frequency following response (FFR) appears to be a naturally occurring, unconscious or autonomic response in the brain to the introduction of an auditory stimulus. In this case, the FFR is the response of a participant to a binaural beat. As discussed previously, when the brain mixes the mismatched signals from the two ears simultaneously and sends the integrated sound to the brain from the brainstem, the brain appears to change or adapt to inherently attune to the perception of the beat itself, which is a synthesis of the two slightly dissonant sounds. The theory is that this response shifts the actual brainwave activity, autonomically attuning the frequency of brainwaves to the beat. Closely related to this phenomenon is the term, brainwave entrainment, which also refers to the brain's natural and autonomic tendency to attune to stimulus in the vicinity.

The idea is that by introducing a repeating auditory stimulus, the brain will adjust naturally to match that stimulus. By introducing a binaural beat and adjusting it to a desired frequency, participants could theoretically be given the opportunity to bring about a natural shift in consciousness simply by listening to the beat. With regard to binaural beats, whatever the frequency of the beat difference, the brain begins to attune to a pulsing wave in a very specific frequency range, coaxing slower brainwaves into consciousness. In other words, using brainwave entrainment and the frequency following response, it is possible that one may be able to bring about increased transpersonal levels of awareness.

It seems almost common sense that the brain adapts to sounds, given that most of the inherent organism responses are meant to assist in effective adaptation to the outer environment and survival of the species. Nevertheless, the idea that there may be the technology to consciously induce the brain to respond in a desired way to an externally introduced stimulus as simple as listening to a CD in a walkman is exciting to say the least. "There have been several free-running EEG studies that suggest that a frequency-following response (FFR) to binaural beats may, somehow encourage alterations in overall brain waves and, therefore, arousal states" (Atwater, 2004). "The perceptual experience of binaural beats could be seen as a psychologically disruptive force or patterning force required in the induction of a discrete altered state of consciousness" (Tart 1975).

The naturally occurring physiological adaption known as the FFR is the reason that people unconsciously react to the perceptually mixed signals introduced by listening to binaural beats. It is in many ways what makes the brain attune to the small 1-30 Hz beat itself and integrate the difference into a new, highly specific range of sound. This attunement, or brainwave entrainment, is what opens the door for those who are introducing the beat to attempt to guide the brain to produce very specific waves and therefore very controlled states of consciousness. It is the process by which the brain subconsciously tunes in to the pulse or beat and merges with its frequency, and it occurs outside of normal consciousness, neurologically.

Discussion

Transpersonal practice could be described as the development and practice of a set of routines or methods which have the intention of allowing the participant to

experience the transpersonal realm of awareness. By applying such methods and applying what is learned or discovered, thereby growing holistically, it is the hope to then return to transpersonal levels again and for the process to go on. In practice, transpersonal practitioners hope to continue to tap into aspects of reality that exist beyond what is the current understanding or perception of reality and shift how they see and experience, and therefore behave within the world anew. It may be the hope that this then results in the personal and inevitable collective evolution of human consciousness. The use of binaural beat technology offers a possible tool in this process. It is possible that the use of binaural beats in meditation may allow to more effectively and efficiently moving beyond the scope of everyday consciousness to seek increased vision and connection with the divine.

In traveling beyond reality, the transpersonal practitioner, like other mystics and seekers before them, hope to access levels of knowledge and understanding that can be embodied and shared with the world. This practice seeks to impact the world in each daily interaction, bringing about some kind of collective shift, and effectively changing the scope of humanity's reality altogether, or helping the species evolve. This changing of reality offers dramatic potential for this planet because it offers a way of helping the human species, the exceedingly dominant species on this planet, to evolve. Evolution of the species could mean an end to war, waste, starvation and discrimination, just to name a few potential changes. Perhaps more importantly to some, it could be the key to the very survival of all life on this planet. John Lennon's song, "Imagine" comes to mind in a very real sense when considering just how significant the evolution of consciousness is in terms of the future of our world. "Imagine there's no hunger. I wonder if you can? Nothing to kill or die for. A brotherhood of man (Lennon, 1975)."

In this sense, transpersonal practice seems to take on a whole new meaning and the value of its practice becomes paramount. Human evolution of consciousness could, effectively, save us all! Taking these potentially far reaching implications into account, the use of scientific advances in technology to improve and advance current transpersonal practices seems like an area in need of increased focus. Unfortunately, this reluctance to explore and accept new and revolutionary approaches to existing and established transpersonal and religious methodologies remains extremely embedded and staunch in human nature.

> The self we might live-the real self-is the forbidden self. Our ambitions are far more collective than we might think. In the context of the strivings for competence and success, our uniquely real selves are often marginalized. In the collectively programmed environment of the well-adjusted and successful person, it is a high crime to live one's genuine life in depth. A role must be successfully played, or we lose face. In a climate of collective conformity, an authentic man or woman is often considered to be a nobody. Such a prejudicial program is not only around is and our society, we internalize it and callously reinforce it inside our very beings. We are embarrassed about the unconventional outsider in our deep recesses of our souls (Perkins, 1993).

This fear of change accounts for a major hurdle in the effort to evolve the human species. With very powerful and culturally embedded belief systems in place around religion and spiritual practice, as a collective human culture, we still lack the insight necessary to bridge the gap between science and religion, east and west and the teachings of Jesus or Buddha and Mohammad so that we may work together toward a common purpose. Evolution is in this way blocked by the human attachment to tradition and fear of the unknown.

> It's easy to see that certain types of people will be more likely to reach what psychological researcher and theoretician Abraham Maslow, one of the founders of humanistic psychology, called "peak experience"-and give themselves to new ideas and experiences and who are not afraid of feeling a bit overwhelmed once in

> a while are more likely to have this type of peak experience. They are, therefore, more likely to evolve, to experience their model of reality reorganizing at a higher level of functioning. On the other hand, people who habitually resist new ideas, who resist new experiences, who reject what does not fit the structure of their belief system and have trouble acknowledging doubts about their ways of seeing things-in other words, people who resist the influx of new energy, stimuli and ideas-rarely have peak experiences because they are blocking their potential to evolve. Those with this outlook evolve very slowly, if at all (Harris, 2007).

This resistance to new ideas seems to apply to our species as whole. People seem to fear the vulnerability involved in seeking new transpersonal experiences. Perhaps this explains why throughout history mystics and spiritual aspirants have been crucified, victimized and cast out. Those who have the courage to step out and away from the pack and embody a new way of being that questions existing socially sanctioned advisors becomes a threat to the metaphorical herd of human consciousness. The story of Jesus comes to mind when considering the threat that new and more expansive perspectives can represent to a group of people. Sadly, the followers of this profound being seem to have in most cases fallen prey to the very same ignorance that he seemed to stand against in his time. Thus, despite the noble attempts of a few far reaching transpersonal practitioners, our species remains its own worst enemy in terms of consciousness evolution. Many seem to refuse to open to the possibility that a holistic view of reality may be more effective than taking sides. Binaural beat technology offers a method of evolution free from a cultural doctrine or grouping.

> Evolution, wherever it appears, manifests itself as a series of transcendences, of ascents, of emergences-and emergences of higher order wholes. For to remember is really to re-member, or join again in unity, and that is just why evolution consists of a series of ever-higher wholes until there is only wholeness. Evolution is holistic because it is nature's remembrance of God (Wilber, 2008)

As Wilber describes above, consciousness evolution appears to occur in much the same way that any other form of evolution happens in this universe. An organism evolves when it is placed in a situation by which its current way of being no longer offers the best method to behave or exist in order to survive. Physical chemist and Nobel laureate Ilya Prigogine's work in the area of physics describes evolution in terms of open systems. Such systems are, according to him designed to interact with their environment rather than independent from it.

According to Prigogine, opens systems either become increasingly ordered and complex over time, or die out. He theorized that this occurs due to dispersing entropy or chaos to their environment. By entropy, Prigogine seems to mean the disorganization and confusion experienced when a system is overwhelmed or unable to adequately adapt to its environment. He proposed that order occurs not in spite of chaos but because of it. Evolution and growth are the inevitable product of open systems that survive the slipping into temporary chaos experienced when a system experiences overload. The surviving system reorganizes at higher levels of complexity-and higher levels of functioning, thereby becoming more powerful and dominant (Prigogine, 1983). Bill Harris explains it using the example of a highway.

> A highway system is an example of an open system. It is relatively stable, and can handle relatively large fluctuation in traffic and traffic patterns. If, however, the amount of traffic suddenly increases to a point where there isn't enough room for all of the cars, the system becomes chaotic. But eventually the input lessons, as rush hour ends, and cars cease to overload the system. But if the system develops chronic chaos, highway engineers will widen the road and add more lanes and on/off ramps, sometimes completely reordering the landscape. The new highway construction allows the system to dissipate the entropy the old system could not. This new system is more complex, and more stable-unless congestion increases to a point where once again there is too much input (Harris, 2007).

Such a conception of evolution has some far reaching implications when considering such basic and foundational aspects of our current collectively held beliefs in American culture regarding education, mental health and medical care. It is a commonly held conception that treatment and learning should feel good and not be a struggle. Doctors employ countless medications and methodologies to seek the least intrusive and most gentle treatments. Mental health clinicians stress not to push clients too hard and to always insure that those whom are being treated are minimally upset or challenged. This is considered more therapeutic and safe. Many laws are set up to insure that clinicians abide by these restrictions. Taking Prigogine's concept of evolution or even the Darwinian concept of "Survival of the fittest" (Darwin, 1859) into account, is it possible that in taking such great efforts to protect those in our care that this effectively decreases their capacity to receive the feedback that they most need to evolve? Is it possible that the clinician renders themselves ineffective in the effort to be politically correct and socially respectful? Dr. Phil is an extremely popular television personality that seems to have made his mark in society simply by having the courage to give honest and direct feedback to his clients at the risk of causing emotional pain (McGraw, 2010). People seem to inherently sense that he is pushing them toward a more inclusive perspective of their selves and lives, even if initially they do not feel comfortable with what he is saying.

Other examples of open systems and evolution abound culturally in society. Sports and competition are a huge part of mainstream American culture. It is possible that the inclination toward competition reflects an inherent desire to evolve. The obsession with pushing beyond and overcoming odds could reflect this notion that doing so leads to growth. The term, "No pain, no gain," popular in weight rooms, seems to reflect this idea

as well. Binaural beat technology seems to match this belief by offering a method of enhancing existing transpersonal practices and potentially multiplying the effectiveness of what is now used. Danger might exist in speeding up a process that has traditionally taken a long time to develop, yet so might potential.

> We forget to ask whether the more efficient path is always the best one. In many societies experimentation with growth beyond the ego level is not encouraged. In fact, if it involves an investment of energy that detracts even temporarily from one's material productivity, it may be actually discouraged. Investing time and energy into developing oneself beyond the ego level may be little understood or appreciated by a society where economic success and material possessions are the major criteria by which one is judged. Experimentation with higher states of consciousness may be regarded with suspicion or considered wasteful nonsense (Rama, 1976)

As Prigogine says, organisms either evolve or die off in terms of biological evolution. Metaphorical or psychological death is a huge price to pay for growing when death is a painful or fearful experience. Death is the enemy. When death is a threat, it may take a willingness to take that step into the unknown to truly grow. In this sense, perhaps indeed "Death is the greatest teacher," as alleged in the lessons from the Yaqui sorcerer Don Juan Matus (Castenada, 1998). Taking that risk bears with it the notion that people may need to confront that which most scares them in able to become more evolved. Concepts such as the "Dark night of the soul" described in Christian terms or the "Shadow self" explained in Jungian theory (Jung, 1945) both speak to this process. They offer insight into what may be a universally applied and utterly necessary step in the evolution of human consciousness.

> There was a man
> who was so disturbed
> by the sight of his own shadow
> and so displeased with his own footsteps
> that he determined to get rid of both.

The method he hit upon was to run away from them
So he got up and ran.

But every time he put his foot down
there was another step
while his shadow kept up with him
without the slightest difficulty.

He attributed hi failure
to the fact that he was not running fast enough.
So her ran faster and faster, without stopping.
until he finally dropped dead.

He failed to realize
that if he merely stepped into the shade,
his shadow would vanish,
and if he sat down and stayed still
there would be no more footsteps

-Chuang Tzu

Applied to transpersonal practice, not only may moments of personal crisis and stress be a part of the journey, they may in fact be needed if we hope to truly grow in any real and complete sense. We may need to confront our demons in order to avoid death or "developmental arrest" (Wilber 2008) and spiritual stagnancy. In this sense, the death portion of evolution may simply be a spiritual or personal growth death of sorts, or an end to evolution until we are able to venture outside of this state. Binaural beats appear to offer a method by which one may be able to swiftly and efficiently move beyond this state of arrested transpersonal development simply by listening to nature sounds, music or pink noise embedded with subconsciously heard tones. By entraining the brain to attune to a frequency that will neurologically induce transpersonal levels of awareness, some may have the capacity to evolve from the inside out. A study by The Brain

Research Center in British Columbia tested the originating process and whether it occurs from the beat itself or an internal reaction to the beat.

> Binaural beat sensations depend upon a central combination of two different temporally encoded tones, separately presented to the two ears. We tested the feasibility to record an auditory steady state evoked response (ASSR) at the binaural beat frequency in order to find a measure for temporal coding of sound in the human EEG. The dependence of the binaural beat at ASSR on stimuli at low, temporally coded tone frequencies suggests that it may objectively assess temporal sound coding ability. The phase shift across the electrode array is evidence for more than one origin of the oscillations. The binaural beat ASSR is an evoked response, with novel diagnostic potential, to a signal that is not present in the stimulus, but generated within the brain (Schwarz, Taylor 2005).

Thus according to this study, the brain reacts to the beat by following it inherently. This is important because it highlights just how little is currently known about neurological potential and the ability of the brain to act as a sort of doorway or biological catalyst to the transpersonal realm. Research is just beginning to develop the tools, such as transpersonal research techniques, that are needed to accurately explore such phenomenon and their potential for transformation. What have traditionally been associated with opposing perspectives on reality, transpersonal studies and neurological research may be well advised to look toward each other as complimentary disciplines that have much to offer each other in terms of findings.

> But what if, instead of science telling us about one floor and religion about another, they both told us something different about each and every floor? What if science and religion were related, not as floors in the building, but as equal columns in the mansion? Not one on top of the other, but each alongside the other, all the way up and down? What then (Wilber, 2008).

Clearly this seems to be a time in history when collectively the people are increasingly ready to move beyond dualistic notions of reality. However, taking into account the existing distrust and reluctance inherent in religious and scientific institutions

as well as the competitive, independent, self centered view inherent in this country, reaching a consensus on such a perspective has great risk of encountering much resistance from many people. Truly, those proponents of both/and or integral approaches to understanding represent a significantly small minority at this time.

> All of man's efforts have been directed outwards, and little evolution has taken place in his inner world. His instincts, urges, passions, emotions, thoughts, and actions are as primitive today as they were in less advanced ages. he is engrossed in ignorance which is characterized by restlessness, a blind clinging to earthly existence, perverted individualism, voluptuous abandonment to sensual pleasures, violence, strife and discord (Rama, 1979).

However, the potential cultivated by bridging dichotomous perspectives and the notion that we may need to be challenged to be uncomfortable and vulnerable in able to truly evolve, may mean that those who are engaged in experimentation with methods such a binaural beat technology represent the pioneers that will tomorrow be quoted and discussed by those less comfortable with taking such risks today. Those involved in such pursuits represent a threat to the existing paradigm in the same way as mystics or seekers have throughout the centuries. Though perhaps, and this is a big perhaps, people are more evolved overall now in cultural reaction to such threats, new ideas as radical as brainwave entrainment through simply listening to a binaural beat seem almost impossible to accept by many of today's mainstream members. Reaching a level of awareness similar to an experienced monk, shaman or priest through listening to a soundtrack makes the argument possible that Christ consciousness as described in the Bible is easily accessible to anyone willing and able to put on the headphones daily. Chosen ones or Guru's may simply be people willing and able to trust the process or take the plunge and return to share. In the famous Zen Ox herding pictures from the 12th

century, after the self has completely dissolved and is no more, the next and very last picture or step in the process of enlightenment is entitled, "Return to the Marketplace with Helping Hands" (Garofalo, 2009).

Perhaps to some religions, transpersonal practice seen this way seems less magic and more practical. It may threaten or challenge existing religious institutions to either evolve or die out. Sadly, it does not seem very likely that institutions as powerful and far reaching as our current religious institutions will budge anytime soon. This reluctance to accept new ideas is part of the reason scientific evidence has become such a threat to existing religions. Similarly the reluctance to open to faith based perspectives because they do not fit scientific guidelines for inquiry and are based on subjective experience represent an unacceptable or unworthy ideological stance. Movements that honor both perspectives while adding something new appear a possible doorway to integrating and moving on. Transpersonal psychology appears to be a movement devoted to such a cause, and momentum seems to be picking up with similar practices.

It is important to note, however, that challenging the brain to work in news ways and helping people move outside of their comfort zone should not be confused with the traumatization associated with the experience of prolonged or ongoing crisis. In fact, many studies suggest that binaural beats have the opposite effect on research participants. For example, a 2005 study at Sunderland Royal Hospital tested the use of music embedded with binaural beats on pre-operative patients awaiting surgery.

> Pre-operative anxiety is common and often significant. Ambulatory surgery challenges our pre-operative goal of an anxiety-free patient by requiring people to be 'street ready' within a brief period of time before surgery. Recently, it has been demonstrated that music can be used successfully to relieve patient anxiety before operations, and that audio embedded with tones that create binaural beats within the brain of the listener decreases subjective levels of anxiety in patients with

> chronic anxiety states. We measured anxiety with the State-Trait-Anxiety Inventory questionnaire and compared binaural beat audio with an identical soundtrack but without these added tones and with a third group who received no specific intervention. Mean [95% confidence intervals] decreases in anxiety scores were 26.3% [19-33%] in the Binaural group (p=0.001 vs Audio Group, p< 0.0001vs. No Intervention Group) and 11.1% [6-16%] in the Audio Group (p=0.15 vs No Intervention Group0 and 3.8% [0-7%] in the No Intervention Group. Binaural beat audio has the potential to decrease acute pre-operative anxiety significantly (Padmanabhan, Hildreth and Laws, 2005).

Such studies of binaural beats suggest that the "fight or flight response" associated with beta brainwaves is not a result of listening to binaural beat technology and must be distinguished from the spiritual crisis or evolutionary challenges that one undergoes in experiencing new mental states for prolonged periods of time. Thus it appears that though an evolution of consciousness may involve experiencing necessary confrontations with our darker selves or coming to realizations that had previously been hidden from view and therefore cause some discomfort or fear, this in no way means that someone undergoing trauma over and over again is somehow evolving. This is an important distinction to make, as explained by Dr. Bruce Perry.

> When an adult is threatened and activates this stress response in an extremely prolonged or repetitive fashion, the neural networks involved in this adaptive response will undergo a use dependent alteration. The very molecular characteristics of individual neurons, synaptic distributions, dendritic trees, and a host of other microstructural and microchemical aspects of these important neural networks will change. And in the end effect is an alteration in the baseline activity and reactivity of the stress response systems in the traumatized individual. The brain will resent-acting as if the individual is under persistent threat. The principle of use dependence is at the heart of effective therapy. Therapy seeks to change the brain (Perry, 2009).

By therapy, Perry seems to mean growth or evolution. The "principle of use dependence" that Dr. Perry refers to means basically that in order to help other heal, grow and become more than what they currently are, repetitive methods aimed at neural pathways in the most basic parts of the brain structure need to be stimulated and coaxed

to develop new neural pathways. The very chemistry of the brain must change. Dr. Perry is a big proponent of providing repetitive kinesthetic experiences that stimulate our most primitive or foundations areas of the brain first and foremost.

It is in these primitive or foundational parts of the brain, the brainstem, that binaural beats are first introduced into the brain. As discussed earlier, the stress response in terms of brainwave activity occurs in the upper beta frequency range. Prolonged experiences within that range, according to Dr. Perry, result in the brain becoming accustomed to remaining in that state. It seems an important side note, therefore, that in encouraging participants in binaural beat technology to experience a new approach to reality, that great care is taken to honor and support each participant's individual experience, needs and path. Clearly a balance must be found between the reorganizing of the brainwave frequencies through entrainment and the pre-existing mental health needs that may already exist.

In other words, though listening to binaural beats themselves may be extremely anxiety reducing and therapeutic for the participant, the more subtle effect of prolonged entrainment into a more transpersonal mind state and the resultant confrontations with the limitations of our ego and shadow aspects of self that lie beyond may trigger participants in some very concerning ways. Wilber's discussion of evolution is one example of a theorist pointing to this critical point, when he explains that to evolve in consciousness one must truly have reached the edge of that particular vantage point. In other words, evolution beyond the ego cannot occur in a prolonged or permanent sense until we have become fully comfortable and confident within the egoic realm. Only then do we begin to intuitively seek something more.

> Fulfillment means that the individual has generally fulfilled the basic tasks of a given stage of wave. A basic competence has been established at that level. The person does not have to perfectly master a given level of stage, but simply function adequately enough to move forward. If the person does not do so, then developmental arrest sets in and further transformation is unlikely. There is a more subjective way to put this: individuals need to fully taste a given stage, get their fill of it, and thus be ready to move on. A person still hungry for a particular food of a given stage will simply not look elsewhere. On the other hand, if the person has tasted a stage and become fairly full, then he or she is open to transformation. In order for this to occur, some sort of dissonance generally has to set in. The new wave is struggling to emerge, the old wave is struggling to hang on, and the individual feels torn, feels dissonance, feels pulled in several directions (Wilber, 2008).

Taking this key observation into account, it seems very important that the use of binaural beat technology, which may very well represent a method with the scientifically verifiable potential to effectively speed up the evolutionary process of consciousness, be engaged in with ongoing, dependable support in place. People who have a history of trauma or existing mental health conditions may be at risk. Centerpoint Research Institute in Beaverton, Oregon is perhaps the leading organization currently devoted to the research, development and application of binaural beat technology in transpersonal practice (Centerpointe, 2010). Bill Harris, quoted throughout this paper, is the owner and spokesperson for this organization. Centerpoint maintains a 24 hour support network for those who engage in their program due to the intensity of experiences that participants report as they begin to experience increased contact with transpersonal levels of awareness. The understanding that participants may experience moments of crisis associated with their evolution is integral to this program.

The symbolism of the death and rebirth of Christ, the concept of reincarnation in Buddhist and Hindu traditions and various death and rebirth ceremonies involved in most Shamanic traditions all seem to honor this step in the process of "Individuation" as Jung

described it (Jung, 1945). According Centerpoint staff, the support network is reportedly a heavily relied upon tool in the program by participants (Harris, 2007). People seem to need a crisis line 24 hours a day to attempt to deal with the intense neurological and transpersonal changes which they are undergoing as the brain is stimulated in ways and challenged to adapt. This need speaks to the powerful impact that binaural beats may have on the brain and mind as well as the connection of neurological and transpersonal aspects of reality. It suggests that when it comes to evolution, the old saying, "with great risk comes great reward" may accurately describe the potential inherent in the use of binaural beats in transpersonal practice, and that the safest or most tame route may not be the most effective route when it comes to consciousness evolution. Sometimes things may need to be shaken up in order to change.

Conclusion

Research into the impact of binaural beats on the brain is very much in its infancy. Although evidence appears to be growing in the neuroscientific community that binaural beats are indeed a legitimate phenomenon that triggers the auditory and resultant whole brain changes described in this paper, what specific positive or negative changes occur in terms of consciousness and mental states of awareness seems very limited at this time. Moreover, what information that is available on shifts in consciousness from binaural beats seems to operate under the basic and generalized descriptions of EEG changes in brainwave frequency presented in this paper. It remains unclear what short or long term impact the use of this technology actually has on a person using it daily to meditate. Such limited information seems to strongly warrant closer and more accurate investigation and

exploration into the more subtle states of consciousness identified in transpersonal research and writings.

Emerging transpersonal methodologies of inquiry designed to integrate and more accurately explore such subtle shifts in consciousness and resultant changes in subjective and objective perception would also seem to offer enormous potential to still a biology based, objective, quantitative and medically grounded approach to this topic overall. Therefore, further research on specific transpersonal or consciousness states would seem to have a great deal if potential in terms of where specifically the ideology and practices of the various theorists and researchers in the field conflict and connects with the work coming out of the field of neurology. Another interesting direction that future work could take could look into audition itself and the relationship between people that are considered auditory learners or people that are particularly inclined or skills with using their ears.

Those who are blind and may have relied upon a more developed hearing faculty out of necessity may have much to teach in terms of the relationship between the neurological comfort or development of audition and response to binaural beats. Research into ancient religious theories and practice and the potential uses of binaural beats would seem interesting as well, particularly given the vast data available in terms of maps of consciousness that has been in place for thousands of years. As mentioned, the "fight of flight" and "relaxation" responses and their current relationship to mental health disorders and illness such as ADHD, anxiety disorder, adjustment disorder, PTSD, psychosis and personality disorders may be a very interesting direction to move in terms of future research. Some very powerful links may be found between the clear imbalance in society

between upper beta states and time spent in the other states of consciousness. The use of binaural beat technology in schools, prisons and mental health treatment all offer very useful potential areas of future inquiry. Finally, a partnership with a leading organization that is currently manufacturing, researching and implementing binaural beat technology for large scale distribution would seem a particularly useful path to take for future research. Overall, any of these directions and many more offer potential for future research with binaural beat technology.

Additionally, the marriage of neuroscientific and transpersonal research methods seems to offer great potential for exploring what remains to be a relatively untested phenomenon, little to unknown, if not outwardly rejected to many within the scientific and religious communities. Perhaps as a result of these limitations in practice, organizations and individuals devoted to the potential inherent in the use of binaural beat technology have simply gone about conducting their own studies or explorations and developing their approaches to its use without a huge consensus of the scientific and religious communities. In this way, the use of this technology and impact of it upon the collective culture has essentially grown out of the marketing of programs using binaural beats to the new age community at large. Given that this community is normally open and interested in new experiences, it is not surprising that the agencies offering this product boast huge increases in the use of binaural beat technology worldwide.

Perhaps the fact that it has grown from the bottom to the top in terms of the scholarly elite is even more inspiring in terms of the widespread potential uses of binaural beats in transpersonal practice. It could be that the true test as to whether introducing binaural beats to the brain and using them to entrain and induce slower brainwaves offers

an effective method for transpersonal practice lies in the results that listening to these stimuli over time has on participants that purchase the product and the reports that they offer. One visit to Centerpointe's website on Holosync technology provides more than enough reports from happy users of the product. A simple search online with the key word "Holosync" results in a page listing thousands of dedicated users of the product. The popularity of such a product alone warrants closer and more inclusive research on the impact that these auditory stimuli have on the brain, with particular interest or focus on what specific states of consciousness emerge as a result of its use.

In the course of discussing this topic and its relationship to transpersonal practice, additional insights and thoughts were presented regarding the nature of the relationship between science and religion, evolution and the process by which the human mind grows. Some other topics initiated in this paper that seem ripe for future research surround the importance of an integral approach to research design, research methods designed specifically with transpersonal levels of consciousness in mind and the importance of moving beyond limiting perspectives. As always, the ever present and underlying use in the application to spiritual growth or consciousness evolution will be a focus of any future work completed. It is this latter calling, the inherent call to be more and become more complete, holy and whole, that offers the deepest and most inspiration regarding humankind and our world.

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